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(54) **BALLISTIC PROJECTILE-ARRESTER, HAVING A REGENERATION AND/OR RECOVERY SYSTEM FOR THE IMPACT MATERIAL.**

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Description

The present invention relates to a ballistic projectile-arrester having a regeneration and/or recovery system for the impact material, said projectile-arrester being suitable for firing with small arms or with arms of other kinds, in particular in indoors firing grounds or shooting-galleries. More particularly, the present invention relates to a ballistic projectile-arrester for small arms that are capable of shooting high kinetic energy projectiles, said projectile-arrester comprising, as a slowing down structure, a granular material system which is preferably fireproof and allows a soft impact with the projectile and the dissipation of said kinetic energy in a fully safe way, as well as a system that allows the granular material to be recovered and the fired projectiles to be eliminated.

As it is well known, a large number of the most various structures have been adopted up to the present time as ballistic projectile-arresters, which structures are effected by serious practical drawbacks and pollution problems.

For instance, the less sophisticated structures realized up to now, consisting in projectile-arresters made up of walls or stacks of wood, or of piles of pneumatic tires, heaps of sand, embankments, and so on, show the drawbacks of the requirements of a costly and careful maintenance, and of a poor reliability from the safety viewpoint.

Some types of projectile-arresters already known at the present time, consist essentially of a metal impact surfaces which convey, with no possibility of return of the projectiles thanks to their suitable geometric shapes, the projectiles and the respective fragments towards a deceleration or kinetic energy dissipation chamber, where they are finally collected. With such a kind of arrangement, the projectile impact onto the metal causes a large production of fragments, dusts and lead vapors.

It is well evident that the most serious or dangerous drawback of the projectile-arresters of the metal type that remains unsolved is the drawback of the formation of dusts and of lead vapors generated during the strong impact, which is partially inelastic, between the high kinetic energy projectile and the sloping metallic plate onto which the projectile shatters.

Moreover, though the projectile-arresters of the metallic type do not present the unsolvable problem of the rebound, they present, at least at a certain distance, some features of lack of safety for the personnel.

A further serious drawback is the problem of disposal of said lead vapors, as their direct dispersal into the environments would surely give incalculable damages. On the other hand, the disposal of said noxious vapors through a filtering or an

analogous system cannot be proposed because of the very high investment and plant costs, as for instance the need for skilled personnel in the use of the necessary specialized equipment.

A further type of projectile-arrester employed at the present time is that of the non metallic type (i.e., that employing wooden crosspieces, pneumatic tires, sand, etc.), which types present a series of drawbacks that caused the same to be abandoned. Indeed, such projectile-arresters are poorly reliable for the personnel and in addition they become easily saturated with lead and fragments or debris; moreover, they are inconvenient in their maintenance because of the frequent and costly interventions as well as of the periodic substitution of the whole impact structure, be such structure made up of crosspieces, pneumatic tires, rubber slabs etc., or of any other material in traditional use.

More particularly, sand embankments give rise, in addition to lead saturation, also to a persisting dust cloud consisting of siliceous dusts that obscure the end part of the shooting-gallery.

Earth banks are suitable for outdoor firing grounds only, which because of various reasons, are progressively giving way to the indoor grounds.

It is therefore well evident that there is a need for a ballistic projectile-arrester according to the present invention which can obviate, as a result of its structural and functional characteristics, the drawback of dusts and lead vapors formation as well as the drawback of their disposal, as no equipment is to be provided for filtering the smokes or the dust clouds. Moreover, the maintenance problems are simultaneously avoided by means of the employment of the self-regenerating impact system with the projectiles fired.

In the U.S. patent No. 2,411,026 it is described a "Firing range butt" particularly suitable to butts firing ranges used in testing airplanes. The structure described provides two conveyors, respectively horizontal and vertical with respect to the sand, that provides to carry the sand and projectiles toward a screen, where projectiles are separated, and to carry the sand on the top of the heap.

Conner et al. solution cannot provide a reduction of the amount of impact material because the "sand chamber" 48 is completely filled with an immense quantity of sand.

Thus, the above solution, in order to obtain a good projectile absorption, without becoming saturated, requires a large space.

Main object of the present invention is that of providing a ballistic-projectile arrester solving drawbacks set before and realizing a regeneration system that allow to obtain a better separation of granular material from projectiles, by means of supporting and conveyor means that are so de-

signed to allow a better and more regular conveying of the mixture of granular material and projectiles. These advantages are obtained providing said supporting and conveyor means arranged according to the angle of slide of the material, so that, during the conveying, lower internal frictions among the single particles and between the particles and the projectiles are obtained.

With the solution proposed according to the present invention, a ballistic projectile arrester is obtained that allows to have a projectile absorption structure taking up as little space as possible and, at the same time, capable of absorbing a large quantity of projectiles without becoming saturated, maintaining the impact material circulating at a constant rate.

A further object of the present invention is that of supplying a regeneration system which is advantageously realized with a closed air cycle so that the need is avoided of restoring air and of providing interchanges and contacts with the air of the firing ground itself.

It is therefore a specific object of the present invention a ballistic projectile-arrester suitable for fires with small as well as with other types of arms, particularly in the case of indoors firing grounds or shooting-galleries, comprising a projectile impact structure consisting of a granular material in the form of a heap and, a regeneration and/or recovery system for said granular material, with the respective separation of the projectiles, whereby said regeneration and/or recovery system for said granular material is made up of at least a supporting and conveyor means of the mixture of granular material and projectiles and of mechanical means for conveying said granular material back towards distribution means for spreading the same onto the heap of the material itself, characterized in that said supporting and conveyor means are arranged according to the angle of slide of the material mass, so as to cause said mass to move in the transverse direction with respect to the axis of the firing ground.

According to an embodiment of the projectile-arrester of the present invention, said supporting and conveyor means of the granular material are made up of gate means or conveyor belt means.

Advantageously, further conveyor means are provided below said supporting and conveyor means, for conveying the granular material towards said separation means.

Further according to the present invention, such additional conveyor means consist of a metallic conveyor belt, or a synthetic or mixed type conveyor belt, or of another mechanical means.

Advantageously, said separation means comprise delivery means provided within conduit means, whose delivered fluid, which is preferably

air, acts on said granular material mixed with said projectiles and carried direct by said supporting and conveyor means or by said further conveyor means, so that the granular material is pushed and caused to pass through said conveyor conduit means and to reach said heap, while the projectiles drop by gravity into the collection means.

According to the present invention, the fluid acting as separating agent of the granular material from the projectiles, is introduced again into said delivery means through further conduit means connecting said delivery means with the top of said material heap.

In particular, said delivery means can be made up of an ejector or a blower, and automation and self-regulating means can also be provided for the recirculation process on said separation and successive conveyor means.

It should be noted that filtering means can also be provided upstream said conduit means connecting the delivery means with the top of the heap.

Advantageously, a melting crucible is provided downstream the collection means of the recovered projectiles, for melting lead, in which crucible said projectiles are automatically conveyed, and some ingot molds are also provided in which molten lead is solidified in the form of ingots. Said system makes the recovery and reutilization of lead easier, with all consequent well known practical advantages that can be realized in such way.

The present invention will be disclosed in the following according to some specific embodiments of the same with particular reference to the enclosed drawings, wherein:

Figure 1 is a plan schematic view of a projectile-arrester according to the present invention;

Figure 2 it a longitudinal vertical cross-sectional view of the movement group of the impact structure of the projectile-arrester of figure 1;

Figure 3 is a perspective view of the group of figure 2;

Figure 4 is a transverse cross-sectional view of a first embodiment of the regeneration system of the projectile arrester according to the invention;

Figure 5 is a transverse cross-sectional view of a second embodiment of the regeneration system of the projectile arrester according to the invention;

Figure 6 is a perspective schematic view of the regeneration system of the projectile-arrester according to figure 5.

In figures 1-3, it is shown a ballistic projectile-arrester according to the present invention comprising a heap 1 of granular material, making up the impact structure.

With reference number 2 it is indicated the shooting gallery.

Said heap rests on two conveyor belts 3, 4 making up the supporting and conveyor system.

Such belts 3, 4 are capable of keeping the mass according to its angle of slide and are in motion in the horizontal direction, i.e. at right angle to the principal axis of the firing ground.

The regeneration and the reutilization system, shall be one of those described with respect to figures 4-6.

The loading and unloading of the granular material is performed laterally with respect to the heap 1, i.e. respectively at points 5 and 6 of Figure 1.

Numbers 7 and 8 point out the reduction units for the motion respectively of belts 3 and 4. It is clear that, instead of the belts 3 and 4, two metallic sliding gates can be provided.

The projectile, once fired, reaches the target in about 1/10 sec., then it reaches the surface of the deceleration mass consisting of the granular material 1 in which it loses its kinetic energy by friction with the granules, so as to be decelerated till it stops at a distance from the exposed surface that excludes the possibility of any rebound.

On the ground of tests carried out by the Applicant said safety is warranted also in case a volley is fired at the projectile-arrester, with any type of fire-arm officially approved for firing grounds, even from a distance of 2-3 m.

Such feature is assured by the fact that the heap of the stopping material, as soon as the projectile passes through it, closes by effect of gravity before the other projectiles arrive, even in case of volleys.

When the firing tests are started, all the regeneration system components are activated and are kept operating by means of the mere operation of a push-button (not shown).

The granular, together with the projectiles fired into the same, see figure 4, is caused to drop from said conveyor belt 3, 4 onto the conveyor belt 9 that conveys said granular material as well as said projectiles towards a separation zone 10.

A blower 11 is provided upstream said zone and connected to the same through conduit 12, said blower causing the separation of the granular material from the projectiles by the action of the air delivered into said zone 10 through conduit 12.

The granular material is delivered through conduit 13 above the heap 1 while the projectiles will drop by gravity into the collector 14.

The air flow acting as a carrier for the granular material through conduit 13 is filtered in a suitable way, if necessary, and then sent again through conduit 15 to the blower 11, so that a closed cycle is realized that needs no restoring of the air.

In the embodiment of figure 5, the granular material and projectiles fired drop on a sliding gate 16, and then into the conduit 17. A blower 18 is

provided upstream said conduit 17, the blower acting so as to push the mixed mass of the granular material and the projectiles fired up to the zone 19 where the projectiles are collected by gravity into the box 20 whereas the granular material is pushed by the air flow through conduit 21 up to the top of the heap 1.

In that case also, the air is filtered once it has been separated from the granular material, and then it is sent again to blower 18 through conduit 15.

In Figure 6 the hinge of the flapper 22 is pointed out by number 23, whereas number 24 points out the granules passage section.

The results of some firing tests carried out by the Applicant are reported for illustrative purposes:

TEST I

Material to be tested: 20 mm foam rubber in the form of bags of heavy polyethylene

Arm : lightweight automatic rifle "F.A.L.", 7.62 gauge NATO, with SMI 9.30 g projectile

Firing distance: 40 m

Direction of the projectiles: at right angles to the material to be tested

Position of the shooter: on the ground in yard

Results: the first 5-6 projectiles were stopped after going through a thickness of about 1.30-1.50 m of the material with no appreciable deformation.

TEST II

Such test was performed with the same material, the same arm, the same direction of the projectiles and the same position of the shooter, from a distance of 15 m.

Results: the results obtained were similar to those obtained in TEST I, the only difference being an average penetration higher of about 10-20 cm.

TEST III

This test was performed with the same material, the same arm, the same direction of the projectiles as well as the same position of the shooter as in the preceding tests, but the firing distance was 10 m and two tracer projectiles were also employed.

Results: no measurable higher penetration occurred, and no appreciable consequences were observed as a result of the retention of the two tracer projectiles within the material.

The present invention has been disclosed according to some specific embodiments of the same, but it is to be understood that modifications and changes can be introduced into the same by those skilled in the art without departing from the scope of the invention.

Claims

1. A ballistic projectile-arrester, suitable for fires with small arms as well as with arms of other kinds, particularly in indoors firing ground or shooting-galleries, comprising a projectile impact structure consisting of a granular material in the form of a heap (1) and, a regeneration and/or recovery system for said granular material, with the respective separation of the projectiles, whereby said regeneration and/or recovery system for said granular material is made up of at least one supporting and conveyor means (3,4) of the mixture of granular material and projectiles, and of mechanical means (11; 18) for conveying said granular material back towards distribution means (12;21) for spreading the same onto the heap of the material itself, characterized in that said supporting and conveyor means (3, 4) are arranged according to the angle of slide of the material mass, so as to cause said mass to move in the transverse direction with respect to the axis of the firing ground.
2. A ballistic projectile-arrester according to claim 1 characterized in that said supporting and conveyor means (3, 4) of the material are made up of gate means or conveyor belt means.
3. A ballistic projectile-arrester according to claim 1 or 2 characterized in that second means (9) for conveying the granular material towards said separation means are also provided in the lower part and downstream said supporting and conveyor means (3, 4).
4. A ballistic projectile-arrester according to claim 3, characterized in that said second conveyor means (9) consist of a metallic, synthetic or mixed-type conveyor belt, or of any other mechanical means.
5. A ballistic projectile-arrester according to any of claims 1-4, characterized in that said separation means comprise delivery means (11) provided in conduit means (12) and whose delivered fluid, which is preferably air, acts on said granular material mixed with the projectiles, which is conveyed direct by said supporting and conveyor means (3, 4) or by said further conveyor means (9), so that said granular material is pushed through said conveyor conduit means for conveyance back to said heap, whereas the projectiles fall by gravity into collection means (13).
6. A ballistic projectile-arrester according to claim 5, characterized in that the fluid acting as a separating agent of the granular material from the projectiles is introduced again into the delivery means (11,18) through further conduit means (15) connecting said delivery means with the top of said heap.
7. A ballistic projectile-arrester according to claim 5 or 6, characterized in that said delivery means (11) consist of an ejector or a blower.
8. A ballistic projectile-arrester according to claims 5, 6 or 7 characterized in that automation and self-regulation means of the recirculation process are provided on said separation and conveyor conduit means.
9. A ballistic projectile-arrester according to claim 7, characterized in that filtering means are provided upstream said conduit means (15) connecting the delivery means (11,18) with the top of the heap of material.
10. A ballistic projectile-arrester according to claim 1, characterized in that a melting crucible for lead, into which said projectiles are automatically conveyed, and a plurality of ingot molds in which molten lead solidifies in the form of ingots, are also provided downstream said regeneration and/or recovery system for said granular material and for the relative separation of the projectile.

Revendications

1. Dispositif d'arrêt pour projectiles balistiques d'armes légères ou d'armes d'autre genre, particulièrement dans des polygones de tir à couvert ou galeries de tir, comprenant une structure d'impact pour projectiles, qui consiste d'un matériel granulaire en forme de tas (1) et d'un système de régénération et/ou de récupération pour le matériel granulaire avec la séparation des projectiles, ledit système de régénération et/ou récupération pour ledit matériel granulaire et projectiles étant réalisés au moins d'un unique moyen de support et de transport (3, 4) pour le mélange du matériel granulaire et des projectiles et des moyens mécaniques (11, 18) pour transporter ledit matériel granulaire en arrière vers des moyens de distribution (12, 21) pour répandre ce matériel sur ledit tas, caractérisé en ce que lesdits moyens de support et de transport (3, 4) sont arrangés selon l'angle de frottement de la masse de matériel, de façon à faire déplacer laditte masse en direction transversale par rapport à l'axe du

polygone de tir.

2. Dispositif d'arrêt pour projectiles balistiques selon la revendication 1, caractérisé en ce que lesdits moyens de support et de transport (3, 4) de matériel sont réalisés de moyens à vanne ou bande transporteuse. 5
3. Dispositif d'arrêt pour projectiles balistique selon la revendication 1 ou 2, caractérisé en ce que des moyens ultérieurs (9) pour transporter le matériel granulaire vers lesdits moyens de séparation sont arrangés dans la portion inférieure et en aval desdits moyens de support et de transport (3, 4). 10 15
4. Dispositif d'arrêt pour projectiles balistiques selon la revendication 3, caractérisé en ce que lesdits moyens ultérieurs (9) consistent d'une bande transporteuse métallique, synthétique ou de type mixte ou d'autres moyens mécaniques. 20
5. Dispositif d'arrêt pour projectiles balistiques selon une quelconque des revendications 1-4, caractérisé en ce que lesdits moyens de séparation comprennent des moyens d'alimentation (11) arrangés dans des moyens à conduit (12) et dont le fluide d'alimentation, qui est préféra- 25 30 blement de l'air, agit sur ledit matériel granulaire mélangé avec les projectiles, qui est transporté directement par lesdits moyens de support et de transport (3, 4) ou par lesdits moyens de transport ultérieurs (9), de façon à faire déplacer ledit matériel granulaire par lesdits moyens de transport à conduit en arrière vers ledit tas, tandis que les projectiles tombent par gravité dans des moyens de collectage (13). 35 40
6. Dispositif d'arrêt pour projectiles balistiques selon la revendication 5, caractérisé en ce que le fluide agissant comme un agent pour séparer des projectiles du matériel granulaire est introduit de nouveau dans les moyens d'alimentation (11, 18) à travers des moyens ultérieurs à conduit (15) reliant lesdits moyens d'alimentation avec ledit tas. 45
7. Dispositif d'arrêt pour projectiles balistiques selon la revendication 5 ou 6, caractérisé en ce que lesdits moyens d'alimentation (11) consistent d'un éjecteur ou d'un souffleur. 50
8. Dispositif d'arrêt pour projectiles balistiques selon les revendications 5, 6 ou 7, caractérisé en ce que des moyens d'automatisation et de réglage automatique sont arrangés sur lesdits 55

moyens de séparation et de transport à conduit.

9. Dispositif d'arrêt pour projectiles balistiques selon la revendication 7, caractérisé en ce que des moyens de filtration sont arrangés en amont desdits moyens à conduit (15) reliant les moyens d'alimentation (11, 18) avec le sommet du tas de matériel. 5
10. Dispositif d'arrêt pour projectiles balistiques selon la revendication 1, caractérisé en ce qu'un creuset de fusion pour plomb, vers lequel les projectiles sont transportés automatiquement, et une pluralité des coquilles, dans lesquelles le plomb solidifie en forme de lingots sont en outre arrangés en aval du système de régénération et/ou récupération pour ledit matériel granulaire et pour la relative séparation des projectiles. 10 15 20

Patentansprüche

1. Auffangevorrichtung fuer Geschosse von leichten Waffen sowie Waffen anderer Art, insbesondere in bedeckten Schiessplaetzen oder Schiessgallerien, welche eine aus einer haufenfoermigen Anordnung von koernigen Materialien bestehende Anprallstruktur (1) fuer Geschosse und eine Rueckgewinnungs- und/oder Regenerationsanordnung fuer dieses koernige Material, mit Abscheidung von Geschossen enthaelt, wobei diese Rueckgewinnungs- und/oder Regenerationsanordnung fuer das koernige Material aus mindestens einem Trage- und Foedermittel (3,4) fuer das aus koernigem Material und Geschossen bestehende Gemisch und mechanischen Mitteln (11, 18) zur Rueckforderung des koernigen Materials zu Verteilungsmitteln (12,21) besteht, die dieses Material auf das Haufen bestreuen, dadurch gekennzeichnet, dass die genannten Trage- und Foedermitteln (3,4) entsprechend dem Reibungswinkel der Materialmasse angeordnet sind, wodurch diese Materialmasse sich in Querrichtung zur Achse des Schiessplatzes verstellt. 10 15 20 25 30 35 40 45
2. Auffangevorrichtung fuer Geschosse nach Anspruch 1, dadurch gekennzeichnet, dass die genannten Trage- und Foedermittel (3,4) fuer das Material aus Rollgitter- oder Foerderbahnmitteln bestehen. 50
3. Auffangevorrichtung fuer Geschosse nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass weitere Mittel (9) zur Foederung des koernigen Materials zu den Abscheidemitteln 55

auch am unteren Teil der genannten Trage- und Foerdermittel (3,4) und stromabwaerts zu denselben angeordnet sind.

4. Auffangevorrichtung fuer Geschosse nach Anspruch 3, dadurch gekennzeichnet, dass die genannten weiteren Foerdermittel (9) aus einem Metallband, Kunststoffband oder einem Mischstoff-Foerdeband oder auch aus anderen mechanischen Mitteln bestehen. 5
10

5. Auffangevorrichtung fuer Geschosse nach Anspruch 3, dadurch gekennzeichnet, dass die genannten Abscheidemittel Zufuhrmittel enthalten, die in Leitungsmitteln (12) angeordnet sind und deren zugefuhrte Fluessigkeit, vorzugsweise Luft, auf das genannte, mit den Geschossen gemischte koernige Material einwirkt, das unmittelbar durch die genannten Trage- und Foerdermittel (3,4) oder durch die genannten weiteren Foerdermittel (9) gefoerdert wird, so dass das genannte koernige Material durch die genannten Foerdermittel zum genannten Haufen rueckgefuehrt wird, waehrend die Geschosse durch Schwerkraft in einen Aufnahmebehaelter herunter fallen. 15
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6. Auffangevorrichtung fuer Geschosse nach Anspruch 5, dadurch gekennzeichnet, dass die als Abscheidemittel der Geschosse vom koernigen Material wirkende Fluessigkeit an die Zufuhrmitteln (11,18) durch weitere Leitungsmittel (15) zurueckgefuehrt wird, die die genannten Zufuhrmitteln mit den Gipfel des genannten Haufens verbinden. 30
35

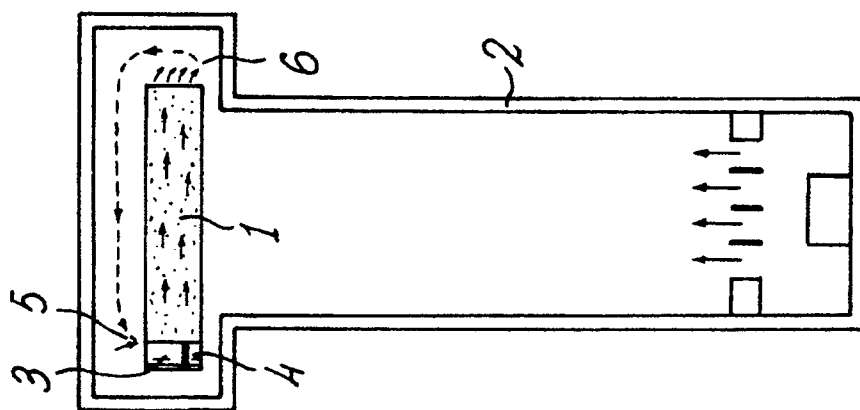
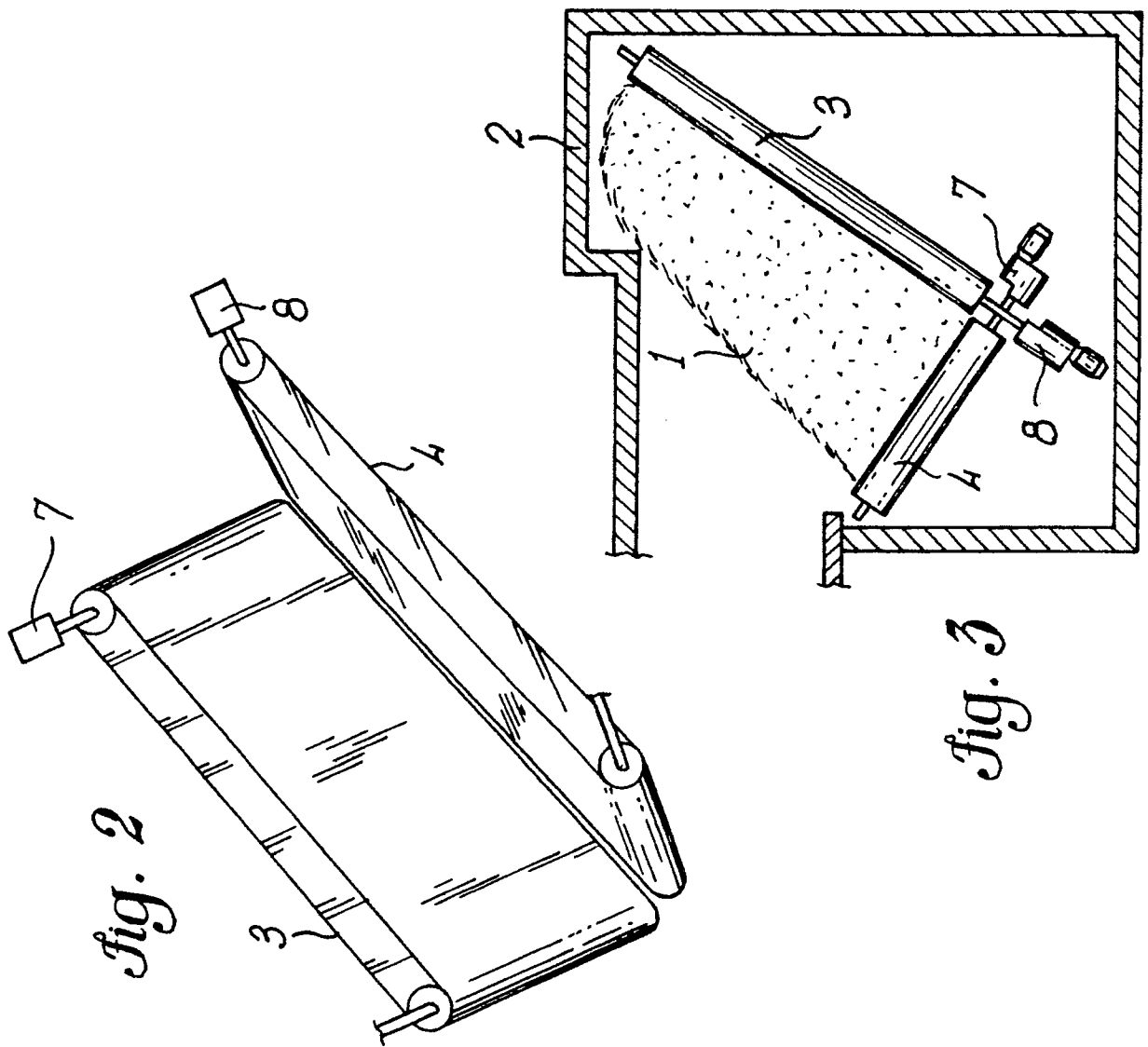
7. Auffangevorrichtung fuer Geschosse nach Anspruch 5 oder 6, dadurch gekennzeichnet, dass die genannten Zufuhrmittel (11) aus einem Ejektor oder Geblaese bestehen. 40

8. Auffangevorrichtung fuer Geschosse nach Anspruechen 5,6 oder 7, dadurch gekennzeichnet, dass an den genannten Abscheide- und Leitungsmitteln Automatisierungs- und Selbsteinstellungsmittel fuer das Ruecklaufverfahren vorgesehen sind. 45

9. Auffangevorrichtung fuer Geschosse nach Anspruch 7, dadurch gekennzeichnet, dass stromauf zum genannten Leitungsmittel (15), die die Zufuhrmittel (11,18) mit dem Gipfel des Haufens verbinden, Filtermittel vorgesehen sind. 50
55

10. Auffangevorrichtung fuer Geschosse nach Anspruch 1, dadurch gekennzeichnet, dass stromab zur genannten Rueckgewinnungs-

und/oder Regenerationsanordnung fuer das genannte koernige Material und fuer die Abscheidung der Geschosse, ein Schmelztiegel fuer Blei, zu dem die genannten Geschosse automatisch zugefuehrt werden, und eine Mehrzahl von Block-Kokillen vorgesehen sind, in den das geschmolzene Blei zu Blocken erstarrt.



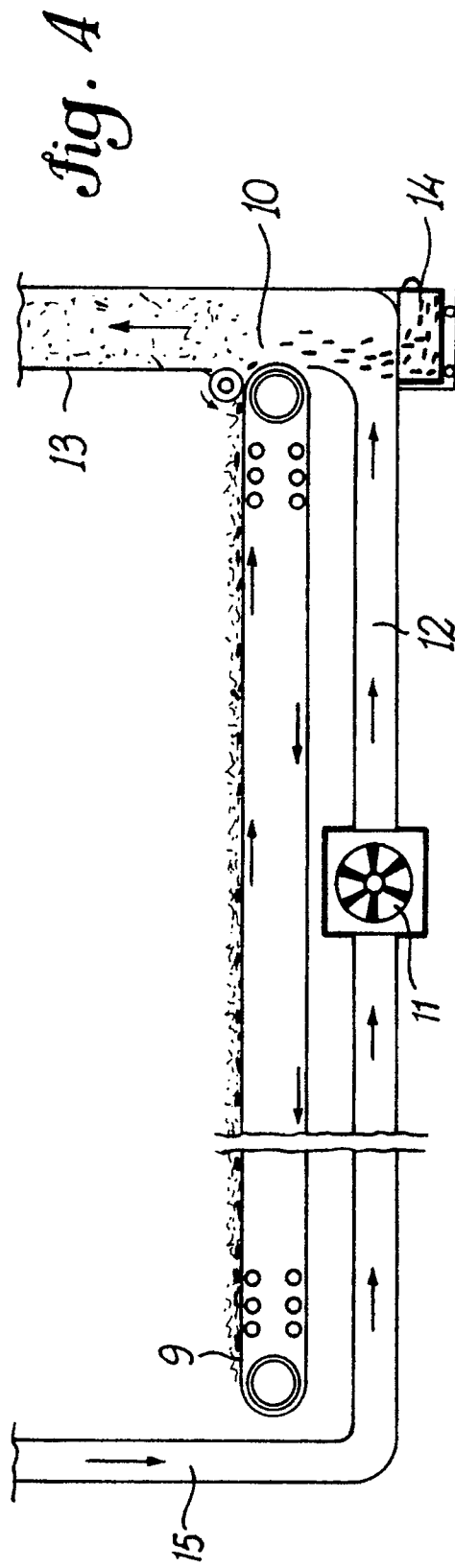


Fig. 5

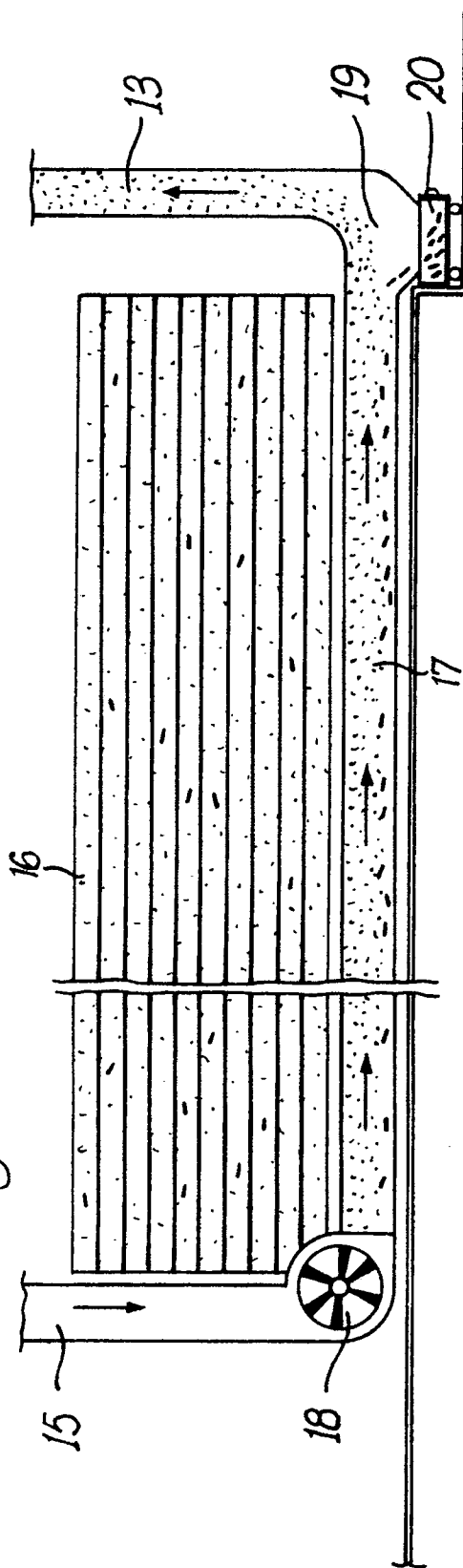


Fig. 6

